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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/525,244	02/22/2005	Ryoji Hoshi	122810	5373
25944	7590	11/13/2007		
OLIFF & BERRIDGE, PLC P.O. BOX 320850 ALEXANDRIA, VA 22320-4850			EXAMINER RAO, G NAGESH	
			ART UNIT 1792	PAPER NUMBER
			MAIL DATE 11/13/2007	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/525,244

Applicant(s)

HOSHI ET AL.

Examiner

G. Nagesh Rao

Art Unit

1792

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 October 2007.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 13, 15, 17, 19 and 21-32 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 15, 17, 19, 27 and 28 is/are allowed.
- 6) ☒ Claim(s) 13, 21-26 and 29-32 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

Continued Examination Under 37 CFR 1.114

1) A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114.

Applicant's submission filed on 10/22/07 has been entered.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2) Claims 13, 21 and 23 are rejected under 35 U.S.C. 102(b) as being anticipated by Fusegawa (US Patent No. 6,117,231).

Examiner would like to point out that claims 13-21 and 23 are being treated as Product by Process claims and according to MPEP 2113 [R-1]

“[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the

product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process.” In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985) (citations omitted) (Claim was directed to a novolac color developer. The process of making the developer was allowed. The difference between the inventive process and the prior art was the addition of metal oxide and carboxylic acid as separate ingredients instead of adding the more expensive pre-reacted metal carboxylate. The product-by-process claim was rejected because the end product, in both the prior art and the allowed process, ends up containing metal carboxylate. The fact that the metal carboxylate is not directly added, but is instead produced in-situ does not change the end product.). The structure implied by the process steps should be considered when assessing the patentability of product-by-process claims over the prior art, especially where the product can only be defined by the process steps by which the product is made, or where the manufacturing process steps would be expected to impart distinctive structural characteristics to the final product. See, e.g., In re Garnero, 412 F.2d 276, 279, 162 USPQ 221, 223 (CCPA 1979) (holding “interbonded by interfusion” to limit structure of the claimed composite and noting that terms such as “welded,” “intermixed,” “ground

in place,” “press fitted,” and “etched” are capable of construction as structural limitations.)”

Fusegawa 231 teaches a Si (silicon) single crystal having a resistivity (ρ) value range of 0.005 to 0.2 $\Omega \cdot \text{cm}$ whereby applicants claimed 0.1 $\Omega \cdot \text{cm}$ falls within claimed range, as well in manufacturing example 1 the Si single crystal was grown with a diameter of 200mm. Furthermore Fusegawa 231 teaches furthermore that the resulting silicon single crystal is shaped into a Si single crystal substrate, noted as having been the wafer sliced from the Si single crystal, where on which a Si single crystal is epitaxially grown (See Abstract and Col. 2-Col. 7). Examiner notes the interval of striations and range controlled with respect to the Si single crystal are viewed as process limitations and bear no consideration to the attributes of the Si single crystal product as claimed by applicant.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3) Claims 22 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fusegawa (US Patent No. 6,117,231) in view of Pietsch (US Patent No. 7,077,726).

From the aforementioned rejection Fusegawa 231 pertains to teaching a Si single crystal and its method of manufacturing.

However Fusegawa 231 fails to address the crystalline product material and the epitaxial layer grown on a wafer cut from the crystal in relation to the specific nanotopology/nanotopography nature of the product.

However in analogous art, Pietsch 726 pertains to a semiconductor wafer with improved local flatness and the method of its production in particular to the nanotopology/nanotopography level of the wafer. Pietsch 726 discloses within range of having the nanotopology/nanotopography range be within the 14nm range as claimed by applicant in a 2mm x 2mm square (See Claim 2, Col. 2 Lines 1-68, Examples 1-2, Col. 14 Line 60 – Col. 17 Line 8).

Therefore it would be obvious to one having ordinary skill in the art at the time of the invention to incorporate the teachings of Pietsch 726 to that of Fusegawa 231 to ensure that the flatness of the wafer is flat at the nanoscopic scale in order to improve upon creating nano-meter based transistors and devices on the wafers in order to fully exploit the expected potentials of the nanotechnology development.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary.

Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35

U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35

U.S.C. 103(a).

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4) Claims 13, 25-26, and 29-32 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Kishida (US Patent No. 6,200,384) in view of Fusegawa (US Patent No. 6,117,231).

Examiner would like to point out that claims 13-24 are being treated as Product by Process claims and according to MPEP 2113 [R-1] “[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product

of the prior art, the claim is unpatentable even though the prior product was made by a different process.” In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985) (citations omitted) (Claim was directed to a novolac color developer. The process of making the developer was allowed. The difference between the inventive process and the prior art was the addition of metal oxide and carboxylic acid as separate ingredients instead of adding the more expensive pre-reacted metal carboxylate. The product-by-process claim was rejected because the end product, in both the prior art and the allowed process, ends up containing metal carboxylate. The fact that the metal carboxylate is not directly added, but is instead produced in-situ does not change the end product.). The structure implied by the process steps should be considered when assessing the patentability of product-by-process claims over the prior art, especially where the product can only be defined by the process steps by which the product is made, or where the manufacturing process steps would be expected to impart distinctive structural characteristics to the final product. See, e.g., In re Garner, 412 F.2d 276, 279, 162 USPQ 221, 223 (CCPA 1979) (holding “interbonded by interfusion” to limit structure of the claimed composite and noting that terms such as “welded,” “intermixed,” “ground in place,” “press fitted,” and “etched” are capable of construction as structural limitations.)”

Kishida 384 pertains to the method of producing silicon (Si) single crystals whereby the single crystal produced is obtained through a controlled pulling method means via the application of a magnetic field which helps control the temperature fluctuation of the silicon melt, and in turn results in controlling the interval of striations incorporated into the single crystal (This phenomenon can be attributed as being known by applicant's admission of prior art in the specification). The interval of striation control range from 1.5 mm or less or 2.3 mm or more is read as a process technique step imposed on the creating the product of silicon single crystal thus it does not bear structural weight to the crystal product. As well Kashida 384 teaches slicing off a wafer from the crystal grown in the referenced teaching.

Furthermore the resistivity value of the silicon single crystal is a dynamic and not a static value, that is to say that it is known that resistivity values for materials are the inverse of the inherent conductivity (σ) value of the material but also resistivity (ρ) is temperature dependent because conductivity is by the mathematical equation $\sigma = ne\mu$ where n means carrier concentration (No. of electrons), e is the absolute charge on the electron, and μ is the mobility value, whereby $\mu = eD/kT$, where T in the equation is temperature value, ergo σ value is dependent on the temperature of the material and with ρ being the inverse of σ , it

too would be temperature dependent. Thus Si single crystal grown as a result of the teachings of Kashida 384 inherently has the capability of satisfying the value as claimed by applicant of $0.1 \Omega \cdot \text{cm}$ based on temperature conditions put forth.

Finally the diameter of the single crystal depends from the crucible it is produced from and Kashida 384 teaches the crucible utilized in producing the Si single crystal is grown out of would produce the crystal at a diameter of 200 mm or more.

Finally with respect to claims 25-32 as related to the above referenced information of Kashida 384 as it pertains to the production of the single Si crystal material, the controlling of the temperature fluctuation is controlled by a variety of manners, most notably the magnetic field impressed to the crystal melt as to inherently it would satisfy the method of growing the material to satisfy the $V \times F / \sin \Theta$ equation as derived by applicant essentially the distance as measure in mm divided by $\sin \Theta$ ergo distance as divided by the function of the angle of the growth surface of the crystal growth (Please see Abstract, Fig. 2, Col 2 Lines 39-68, Col 3 – Col 10 Lines 1-68 (note Col 4 Lines 45-57, Col 6 Lines 1-31)), Tables 1 and 2, Also examiner is including in the NPL a secondary reference “Electronic Materials Science for Integrated Circuits in Si and GaAs” that teaches the thermodynamic calculations behind conductivity and resistivity calculations, please note that this secondary reference is used to teach what is inherently known

and understood about calculated values for the properties of the material's characteristic).

However in order to further substantiate the referenced teachings of Kashida 384, examiner has put forth analogous art Fusegawa 231 which pertains as well to the manufacturing of semiconductor silicon crystal wafer which is obviously cut from single crystal ingots, and Fusegawa 231 substantiates that Si single crystal falls in the $0.1 \Omega \cdot \text{cm}$ resistivity value with teaching a range of 0.005 to $0.2 \Omega \cdot \text{cm}$. Furthermore Fusegawa 231 teaches growing the epitaxial layer of Si single crystal ontop of the single Si crystal wafer (See Abstract and Col. 2-Col. 7).

It would therefore be obvious to one having ordinary skill in the art at the time of the invention to incorporate the steps and knowledge of Fusegawa 231 into that of Kashida 384 in order to further optimize the material parameters for the production and crystal structure and strength of the Si single crystal material.

Allowable Subject Matter

5) The following is a statement of reasons for the indication of allowable subject matter: Claim language (i.e. Claims 15, 17, 19, 27, 28) pertaining to silicon single crystal relevant limitations are deemed allowable in view of the Declaration filed 9/18/07. Since evidence is put forth suggesting an unanticipated

and unobvious variant product as demonstratively claimed in the product by process claim language by applicant.

Response to Arguments

6) Applicant's arguments filed 10/22/07 have been fully considered but they are not persuasive. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Examiner respectfully disagrees with applicant's contention pertaining to the limitation of the interval of striations structure to the product by process claims put forth by applicant. These striations are inherently going to exist in crystal structures, based on the employed techniques utilized by applicant and known to use by one having ordinary skill in the art in the prior art cited.

Applicant's are essentially claiming a crystal structure and this structure has a desired number interval of striations, if applicant can show that this product exists via a 37 CFR 1.132 affidavit/declaration with additional results with data

conclusively showing this crystal is different from other known crystals in the art as being an “unexpected result”, then examiner may be inclined to shift position regarding the validity of the rejection and prior art put forth anticipating/obviating said claimed invention.

Which in this case that applicant has shown proof for examiner to indicate allowable subject matter via the declaration, however the independent claim is directed towards a single crystal, not a silicon single crystal. It is advisable that applicant's consider incorporating the allowable dependent claim language into the independent claims since that would be considered an allowable claimed invention as supported by applicant's remarks and declaration filed in case prosecution history.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to G. Nagesh Rao whose telephone number is (571) 272-2946. The examiner can normally be reached on 9AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Barr can be reached on (571)272-1414. The fax

phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

GNR

*/Robert Kunemund/
Robert Kunemund
Primary Examiner
TC 1700*